draft, it becomes possible to take into account the manner in which metallurgical furnaces operate.

The pressure of the gas within the laboratory of the furnace is zero. The firebox acts to *pump* the elements necessary for the formation of the flame into the furnace, and the chimney acts to remove the products of combustion. This is the case with all such furnaces and with all systems of heating, whether simple coal-fired or using producer gas with or without the recuperation of the heat. This rule is also applicable to coke ovens, to kilns for the burning of brick or for the calcining of ores.

Each firebox acts as a *force pump,* functioning in the following manner: assume that the firebox *A* (Fig. 15) is filled with gas at a temperature of 1200°, that is to say, the specific weight of this

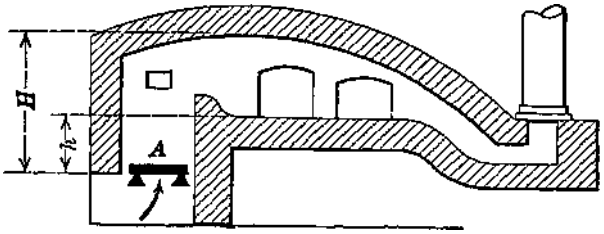

FIG. 15.

gas will be about one-fifth the weight of air. Under these conditions each particle of air which is near the grate is acted upon, on the side of the furnace, by the pressure of a column of gas *h,* which is only one-fifth the weight of that which acts upon it on the side exposed to the outside air. It is evident that a current of air will be established by the action of this positive pressure, which will be equal to the difference between the weight of a column *h* of the outside or cold air and the same column of hot gases.

The height of the column has been taken as *h* and not as 7iT, because, in the furnace chamber, the current of hot gases rising from the firebox must always be taken with

regard to the hearth level.

The positive pressure which is measured by the height of the column h is expended: (a) in overcoming the resistance of the bed of fuel to the passage of the air and the gas; (6) in creating